

REMARKS

The undersigned notes the Communication from the Examiner dated September 11, 2007, wherein the Amendment filed June 5, 2007 was not entered, as presenting claims directed only to non-elected inventions. In view of this Communication mailed September 11, 2007, Applicants are presenting the amendments herein directed to the elected species of Fig. 1(d).

Thus, Applicants have amended claim 1, as compared to claim 1 in the last entered Amendment (that is, the amendment filed January 17, 2007), to recite that the insulating resin composition layer is formed of “at least one sub-layer”, and to recite that the connection conductor is “all made of a metal.” Note, for example, Fig. 1(d), and note also the description in, for example, the paragraph bridging pages 11 and 12 of Applicants’ specification. In addition, claim 5 has been amended to recite that at least one sub-layer of the insulating resin composition layer, placed at at least one of front and rear outermost layers of the insulating resin composition layer, is mainly made of thermoplastic resin.

Note that claims 40-49 have been indicated as “Not entered”, these claims having been submitted in the aforementioned Amendment filed June 5, 2007.

In the present amendments, Applicants are adding new claims 50-59 to the application. Claims 50 and 51, each dependent on claim 1, respectively recites that at least one sub-layer of the insulating resin composition layer, which is at least one of a front surface layer and a rear surface layer of the insulating resin composition layer, contains a liquid crystal polymer; and recites that the insulating resin composition layer includes at least two sub-layers. Claims 52 and 53, each dependent on claim 50, further define the liquid crystal polymer contained in at least

one of the front and rear surface layers of the insulating resin composition layer; and claim 54, dependent on claim 1, recites that the connection conductor is formed by etching a metallic layer of copper. Claims 55 and 56, each dependent on claim 4, respectively recites that the connection conductor is covered with one or more selected from a specific group of metals; and recites that the connection conductor is covered with metallic film formed by a method of performing electroless copper plating subsequent to application of palladium, copper sputtering or copper sputtering with chromium being a base, print of silver paste, substituted or electroless gold plating, electrolysis or electroless plating of nickel/gold, electrolysis or electroless plating of nickel/palladium/gold, or electrolysis or electroless plating of tin or tin alloy. Claims 57 and 58, each dependent on claim 1, respectively recites that the connection conductor is a solid all-metal member; and recites that a surface of the connection conductor is exposed through at least one surface of the insulating resin composition layer in the thickness direction of the insulating resin composition layer, with the exposed surface of the connection conductor being covered with a metal layer. Claim 59, dependent on claim 58, recites that surfaces of the connection conductor are exposed through both surfaces of the insulating resin composition layer in the thickness direction, with the exposed surfaces of the connection conductor being covered with metal layers.

In connection with amendments to previously considered claims, and in connection with the newly added claims, note claims Fig. 1(d) and the corresponding description in connection therewith, in the paragraph bridging pages 11 and 12 of Applicants' specification.

Applicants have cancelled all non-elected claims previously in the application, without prejudice or disclaimer, and in particular without prejudice to the filing of a Divisional application or applications directed thereto.

It is respectfully submitted that all of the claims presently pending in the above-identified application read on the elected specie of Specie II (Fig. 1(d)).

The objection to claim 5 as set forth in Item 2 on page 2 of the Office Action mailed March 5, 2007, is noted. Applicants have amended claim 5 to recite that at least one sub-layer of the insulating resin composition layer, placed at at least one of front and rear outermost layers of the insulating resin composition layer, is mainly made of thermoplastic resin. Thus, it is respectfully submitted that claim 5 as presently amended is clear with respect to the sub-layer “mainly made of thermoplastic resin”, and location thereof.

The comment by the Examiner in Item 2 on page 2 of the Office Action mailed March 5, 2007, that if the insulating resin composition layer is made of one layer, “the structure of front and rear outermost layers as recited in claim 5 is not clear”, is noted. It is respectfully submitted that claim 5 as presently amended is clear with respect to the sub-layers mainly made of thermoplastic resin, where there is only one sub-layer or more than one sub-layer (including where such at least one sub-layer is placed at “at least one” of front and rear outermost layers of the insulating resin composition layer). In view of present amendments to claim 5, reconsideration and withdrawal of the objection thereto is respectfully requested.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner on the merits, patentably distinguish over the teachings of the reference applied by the Examiner in rejecting claims in the Office

Action mailed March 5, 2007, that is, the teachings of U.S. Patent No. 6,518,514 to Suzuki, et al., under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that this reference as applied by the Examiner would have neither taught nor would have suggested such a connection board as in the present claims, having the specified insulating resin composition layer and the connection conductor formed so as to pass through the insulating resin composition layer in its thickness direction at a specified position, and wherein the connection conductor is all made of metal. See claim 1.

More particularly, it is respectfully submitted that the applied reference would have neither taught nor would have suggested such connection board as in the present claims, having features as discussed previously in connection with Claim 1, and, wherein the connection conductor is a solid all-metal member (see claim 57).

Furthermore, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested such a connection board as in the present claims, including exposure of a surface of the connection conductor through at least one surface of the insulating resin composition layer in the thickness direction, with the exposed surface of the connection conductor being covered with a metal layer (see claim 58), more specifically, wherein surfaces of the connection conductor are exposed through both surfaces of the insulating resin composition layer in the thickness direction, with the exposed surfaces of the connection conductor being covered with metal layers (see claim 59). Note also claim 4.

In addition, it is respectfully submitted that teachings of the applied reference would have neither disclosed nor would have suggested such a connection board as

in the present claims, having features as discussed previously in connection with claim 1, and wherein the at least one sub-layer of the insulating resin composition layer, placed at at least one of front and rear outermost layers of the insulating resin composition layer, is mainly made of a thermoplastic resin (see claim 5); or wherein at least one sub-layer of the insulating resin composition layer, at at least one of front and rear surface layers of the insulating resin composition layer, contains a liquid crystal polymer (see claim 50), in particular wherein such liquid crystal polymer has properties as set forth in claims 52 and 53.

Furthermore, it is respectfully submitted that the teachings of the applied reference would have neither disclosed nor would have suggested such a connection board as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, wherein the board further includes a conductor circuit which is electrically connected to the connection conductor for at least one surface of the connection board (see claim 2), in particular wherein the conductor circuit is a metallic layer (see claim 3).

The invention as claimed in the above-identified application is directed to a connection board, particularly useful in connection with providing multi-layer wiring substrates and packages capable of providing a high density.

As described on pages 2-4 of Applicants' specification, various inter-layer connection techniques have been proposed in order to obtain reduction in costs, and to provide a high density, for connection boards. As one technique that has been proposed, a bump is formed on a wiring of a substrate by printing a conductive paste; and, then, an inter-layer connection insulating material in a state of B stage and a metallic layer are disposed, and the bump is inserted within a mold resin by

pressing so as to be conductively connected to the metallic layer. Another technique includes embedding plated wires into an elastomer in its thickness direction, for connecting two conductors.

However, previously proposed techniques have various problems, as described in the last full paragraph on page 2, the paragraph bridging pages 3 and 4, and the first full paragraph on page 4, of Applicants' specification.

Against this background, Applicants provide a structure wherein inter-layer connection can be achieved only at required positions without performing a filling step, a good via structure with good electrical connection can be provided, reliably connecting with a fine wiring circuit, high mechanical and thermal precision can be accomplished, and multiple layers can be formed. Applicants have found that by utilizing the connection board including the connection conductor as in the present claims, the connection conductor being all made of metal, features as discussed previously are achieved. In particular, through use of connection conductor which is solid and all made of metal, an economical connection conductor is achieved, having excellent mechanical strength.

Further, as an additional feature of the present invention, one or both surfaces of the connection conductor are covered with metallic layers.

Where the connection conductor is made only of metal, and in particular where surfaces thereof are covered with metallic layers, a conductor circuit can be provided electrically connected thereto with improved connection reliability. This is because metals of the layers can be subjected to solid phase metallic diffusion and made into an alloy at an interface therebetween, or the layers can be melt-bonded with each other, providing improved connection reliability.

Suzuki, et al. discloses a circuit board which includes (1) not less than two wiring layers; (2) an insulator layer for electric insulation between the wiring layers; and (3) an inner-via-hole conductive member provided in the insulator layer in a thickness direction of the insulator layer for electric connection between the wiring layers. This patent goes on to disclose that the insulator layer is made of a composite material containing an organic resin and a material having a smaller thermal expansion coefficient than that of the organic resin, and includes a surface part, a core part and a surface part laminated in the stated order, the surface part having a relatively high content of the organic resin, and the core part having a relatively low content of the organic resin. This patent goes on to describe that the wiring layers have a land portion that is connected with the inner-via-hole conductive member, the land portion being embedded so as to be substantially in contact with the core part, and the inner-via-hole conductive member having a thickness substantially equal to a thickness of the core part. Note column 2, lines 14-37. See also column 3, lines 36-42; and column 4, lines 26-29, 37-40 and 47-50. Note also column 6, lines 6-10 and 40-50. This patent further discloses that in the configuration of the circuit board, the inner-via-hole conductive material preferably is made of a composite material of a conductive filler and an organic resin; and that, in this case, the conductive filler preferably is made of at least one selected from the group consisting of gold, silver, copper, nickel, palladium, lead, tin, indium and bismuth, alloys of these, and mixtures of these. See column 5, lines 36-43. Note also column 7, lines 1-6.

Attention is directed to Fig. 1 of Suzuki, et al, and the description in connection therewith in column 5, lines 47-58. This discloses that the circuit board in Fig. 1 has inner-via-hole connectors 102 formed in the insulator layer 101 and made

mainly of a metal. See also column 6, lines 6-10 of Suzuki, et al, disclosing a conductive paste put in the through-hole; and note also column 6, lines 40-50 of Suzuki, et al, disclosing inner-via-hole connectors made of a conductive resin composition containing a conductive filler.

It is emphasized that Suzuki, et al, primarily focuses on use of conductive paste (that is, a conductive material in a resin binder) filling the inner-via-hole, in forming the inner-via-hole conductive member. It is respectfully submitted that such paste has various drawbacks, in that the conductive paste cannot be utilized in melt-bonding or made into an alloy. It is respectfully submitted that Suzuki, et al, would have neither taught nor would have suggested the presently claimed invention, including advantages thereof.

Furthermore, it is respectfully submitted that Suzuki, et al, would have neither taught nor would have suggested the other features of the present invention as discussed previously, including, inter alia, the covering of exposed portions of the connection conductor with metal, more particularly, with a metal layer (note claims 4, 58 and 59); and/or use of liquid crystal polymer for surface layers of the insulating resin composition layer, and/or other features of the present invention as discussed previously.

In connection with the prior art rejection in the Office Action mailed March 5, 2007, the Examiner refers to Fig. 2 and Figs. 3a - 3b of Suzuki, et al, as disclosing, inter alia, connection conductor 209 and a conductor circuit (circuit formed on the insulating layer, see Figs. 3C and 3E) which is electrically connected to the connection conductor. It is emphasized that as disclosed in Suzuki, et al, of the through holes are filled with a paste-like copper-epoxy resin composition 209 by

printing or another technique. It is respectfully submitted that such disclosure in Suzuki, et al, would have taught away from the presently claimed invention, including wherein the connection conductor is all made of metal, it began being emphasized that the paste-like filler of the through holes includes epoxy resin in Suzuki, et al.

The contention by the Examiner in connection with claim 4, on page 3 of the Office Action mailed March 5, 2007, is noted. In column 9, lines 16-19, of Suzuki, et al, with reference to Fig. 3D, there is a disclosure of wiring patterns being formed on external surfaces of the copper foils 210, so that lands 211 are formed. It is respectfully submitted that such lands are on external surfaces of the copper foils 210. Thus, it is respectfully submitted that the wiring-pattern-formed surfaces of the copper foils 210 (that is, the conductor circuit) are covered by the lands 211, and not the inner-via-hole connectors 209 being covered by the lands 211. It is respectfully submitted that Suzuki, et al, would have neither taught nor would have suggested the subject matter of claim 4, much less the subject matter of claims 50 and 59, and advantages thereof as discussed previously.

In view of the foregoing comments and amendments, it is respectfully submitted that the presently submitted Amendment constitutes a complete and proper response to the Office Action mailed March 5, 2007. Accordingly, entry of the present Amendment as a matter of right; and reconsideration and allowance of all claims remaining in the above-identified application, are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Authorization is herein given to charge any shortage in the fees,

including extension of time fees and excess claim fees, to Deposit Account No. 01-2135 (Case No. 1204.43988X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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